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§ 218.1 Policies.

(a) Upon request by the Veterans Administration in connection with a claim for compensation, or by a veteran or his or her representative, available information shall be provided by the applicable Military Service which shall include all material aspects of the radiation environment to which the veteran was exposed and shall include inhaled, ingested and neutron doses. In determining the veteran's dose, initial neutron, initial gamma, residual gamma, and internal (inhaled and ingested) alpha, beta, and gamma shall be considered. However, doses will be reported as gamma dose, neutron dose, and internal dose. The minimum standards for reporting dose estimates are set forth in § 218.4.

(b) The basic means by which to measure dose from exposure to ionizing radiation is the film badge. Of the estimated 220,000 Department of Defense participants in atmospheric nuclear weapons tests, about 145,000 have film badge dose data available. The information contained in the records has been reproduced in a standard format and is being provided to each military service, which can use the film badge dose data to obtain a radiation dose for a particular individual from that service. This is done upon request from the individual, the individual's representative, the Veterans Administration, or others as authorized by the Privacy Act. Upon request, the participant or his or her authorized representative will be informed of the specific methodologies and assumptions employed in estimating his or her dose. The participant can use this information to obtain independent options regarding exposure.

(c) From 1945 through 1954, the DoD and Atomic Energy Commission (AEC) policy was to issue badges only to a portion of the personnel in a homogeneous unit such as a platoon of a battalion combat team, Naval ship or aircraft crew. Either one person was badged in a group performing the same function, or only personnel expected to be exposed to radiation were badged. After 1954, the policy was to badge all personnel. But, some badges were unreadable and some records were lost or destroyed, as in the fire at the Federal Records Center in St. Louis. For these reasons the Nuclear Test Personnel Review (NTPR) Program has focused on determining the radiation dose for those personnel (about 75,000) who were not issued film badges or for whom film badge records are not available.

(d) In order to determine the radiation dose to individuals for whom film badge data are not available, alternative approaches are used as circumstances warrant. All approaches require investigation of individual or group activities and their relationship to the radiological environment. First, if it is apparent that personnel were not present in the radiological environment and had no other potential for exposure, then their dose is zero. Second, if some members of a group had film badge readings and others did not—and if all members had a common relationship with the radiological enviroment—then doses for unbadged personnel can be calculated. Third, where sufficient badge readings or a common relationship to the radiological environment does not exist, dose reconstruction is performed. This involves correlating a unit's or individual's detailed activities with the quantitively determined radiological environment. The three approaches are described as follows:

(1) Activities of an individual or his unit are researched for the period of participation in an atmospheric nuclear test. Unit locations and movements are related to areas of radiation. If personnel were far distant from the nuclear detonation(s), did not experience fallout or enter a fallout area, and did not come in contact with radioactive samples or contaminated objects, they were judged to have received no dose.

(2) Film badge data from badged personnel may be used to estimate individual doses for unbadged personnel. First, a group of participants must be identified that have certain common characteristics and a similar potential

for exposure to radiation. Such characteristics are: Individuals must be doing the same kind of work, referred to as activity, and all members of the group must have a common relationship to the radiological environment in terms of time, location or other factors. Identification of these groups is based upon research of historical records, technical reports or correspondence. A military unit may consist of several groups or several units may comprise a single group. Using proven statistical methods, the badge data for each group is examined to determine if it adequately reflects the entire group, is valid for use in statistical calculations, or if the badge data indicate the group should be sub-divided into smaller groups. For a group that meets the tests described above, the mean dose, variance and confidence limits are determined. An estimated dose equal to 95% probability that the actual exposure did not exceed the estimate is assigned to unbadged personnel. This procedure is statistically sound and will insure that unbadged personnel are assigned doses much higher than the average/mean for the group.

(3) Dose reconstruction is performed if film badge data are unavailable for all or part of the period or radiation exposure, if film badge data are partially available but cannot be used statistically for calculations, special activities are indicated for specific individuals, or if other types of radiation exposures are indicated. In dose reconstruction, the conditions of exposure are reconstructed analytically to arrive at a radiation dose. Such reconstruction is not a new concept; it is standard scientific practice used by health physicists when the circumstances of a radiation exposure require investigation. The underlying method is in each case the same. The radiation environment is characterized in time and space, as are the activities and geometrical position of the individual. Thus, the rate at which radiation is accrued is determined throughout the time of exposure, from which the total dose is integrated. An uncertainty analysis of the reconstruction provides a calculated mean dose with confidence limits. The specific method used in a dose reconstruction depends on what type of data are available to provide the required characterizations as well as the nature of the radiation environment. The radiation environment is not limited to the gamma radiation that would have been measured by a film badge, but also includes neutron radiation for personnel sufficiently close to a nuclear detonation, as well as beta and alpha radiation (internally) for personnel whose activities indicate the possibility of inhalation or ingestion of radioactive particles.

§ 218.2 General procedures.

The following procedures govern the approach taken in dose determination:

(a) Use individual film badge data where available and complete, for determining the external gamma dose.

(b) Identify group activities and locations for period(s) of possible exposure.

(c) Qualitatively assess the radiation environment in order to delineate contaminated areas. If no activities occurred in these areas, and if no other potential for exposure exists, a no dose received estimate is made.

(d) If partial film badge data are available, define group(s) of personnel with common activities and relationships to radiation environment.

(e) Using standard statistical methods, verify from the distribution of film badge readings whether the badged sample adequately represents the intended group.

(f) Calculate the mean external gamma dose, with variance and confidence limits, for each unbadged population. Assign a dose equal to 95% probability that actual exposure did not exceed the assigned dose.

(g) If badge data is not available for a statistical calculation, conduct a dose reconstruction.

(h) For dose reconstruction, define radiation environment through use of all available scientific data, e.g., measurements of radiation intensity, decay, radioisotopic composition.

(i) Quantitatively relate activities shielding, position, and other factors to radiation environment as a function of time. Integrate dose throughout period of exposure.

(j) Where possible, calculate mean dose with confidence limits; otherwise